

ART. XIX.—*On the Bacchus Marsh Sandstones
and their Fossils.*

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The Bacchus Marsh Sandstones are perhaps as well known as any series of rocks in the State of Victoria, not only to Australians, but to geologists generally in other parts of the world. This no doubt is due to the many diverse points of interest which have from time to time been connected with these deposits, and many who are not geologists are familiar with the name from different standpoints. In the first place, we may notice that this stone was opened up and quarried to a considerable extent for the purpose of a building stone. Somewhere about the years 1845 to 1847 the possibilities of this stone as a building stone were first considered, and local use was made of it for several years. Then a Government reward for a building stone within a reasonable distance for certain public buildings in Melbourne, led to a much more extensive quarry being opened, and stone was supplied for the following:—The Treasury, the old Custom House, the Crown Lands Selection Office, the Parliament House Library, and several others.

The stone was not easily obtained, as the over-burden of weathered material was regarded as too great, the jointing was not of a too favourable character, and the deeper excavations failed to yield a stone of uniform colour; in fact, the colour variations, such as concretionary banding, ultimately proved too much for the Melbourne architects.

In the light of our present knowledge it seems remarkable that such a stone should ever have been recommended, for in many respects evidence is not lacking to prove unsuitability. The association of a peculiar conglomerate with these sandstones was early recognised by Mr. A. R. C. Selwyn, as probably point-

ing to glacial conditions, though he clearly states that he found no glacially marked stones. To quote his own remarks, we may refer to the following paragraph¹:—

“The character of the conglomerate beds before mentioned near Darley, and on the Wild Duck Creek, is such as almost to preclude the supposition of their being due to purely aqueous transport and deposition. It is, however, very suggestive of the results likely to be produced by marine glacial transport; and the mixture of coarse and fine, angular and waterworn, material, much of which has clearly been derived from distant sources, would also favour this supposition. Grooved or ice-scratched pebbles or rock-fragments have, however, not yet been observed.”

Since that time innumerable glacial stones of all sorts and sizes have been gathered by many different geologists and their mode of origin proved up to the hilt.

For information in this direction various papers by Messrs. Sweet and Brittlebank, Officer and Balfour, Dunn, David, and others, may be consulted.

This glacial material has become important from an economic point of view, for in the course of ages much of it has been cut out by river action, and as a consequence, washed, bleached and sorted into something like regular sizes. Thus on the flanks of Bald Hill, Darley, we can see fine white clay beds, white sandy clays, grits and coarse gravels mainly composed of the more durable materials such as quartz, jasper and quartzite.

On this deposit a very important industry has arisen in the manufacture of fire-bricks, fire-tiles, retorts, and many other things; and this work has been carried out in such a thorough and painstaking manner that the results are most excellent and satisfactory. The Darley Fire-Brick Company has gone ahead by leaps and bounds solely on the quality of the articles produced by them, and the care and attention exercised in their production. No doubt this will be a permanent undertaking of high commercial value to the State generally.

¹ Selwyn: Exhibition Essays, 1866. Phys. Geol. and Geol. of Victoria, p. 16.

THE FOSSIL FLORA.

- 1.—1847. *Cyclopteris* (?) *angustifolia*, McCoy. A.M.N.H., vol. XX., p. 148, pl. 19, f. 3, 3a.
- 2.—1861. *Gangamopteris angustifolia*, McCoy. Trans. Roy. Soc. Vic., 1860, vol. V., p. 107, and footnote.
- 3.—1866. *Gangamopteris angustifolia*, McCoy. Rec. Zool. and Pal. Vic., Exhib. Essay, p. 21.
- 4.—1875. *Gangamopteris angustifolia*, McCoy. Prod. Pal. Vic., Dec. II., pp. 11-12, plates 12, (f. 1) and 13 (f. 2).
Gangamopteris spatulata, McCoy. Id., p. 12, pl. 13, f. 1, 1a.
Gangamopteris obliqua, McCoy. Id., p. 13, pl. 12, f. 2-4.
- 5.—1892. *Schizoneura* sp. McCoy. Ann. Rep. Dept. of Mines, Vic., for 1891, p. 30.
Zengophyllites sp. McCoy. Id.
- 6.—1894. *Ptilophyllum officeri*, McCoy. Proc. Roy. Soc. Vic., vol. VI., p. 143.
- 7.—1898. *Taeniopteris sweeti*, McCoy. Proc. Roy. Soc. Vic., vol. X., pt. 2, p. 285.
- 8.—1905. The *Glossopteris* Flora, by E. A. Newell Arber. Brit. Mus. Catalogue. Contains several references to this locality and its flora.

The first record of fossils from these sandstones was made by the late Sir Frederick McCoy as far back as 1847, which was practically contemporaneous with the opening up of the quarries in this district. In this paper, which was contributed to the Annals and Magazine of Natural History, McCoy named and figured a plant as a doubtful *Cyclopteris* under the specific name of *angustifolia*.

It was not until the year 1861 that we find the first proposal of the genus *Gangamopteris* in the Transactions of the Royal Society of Victoria, and even then it is not of a very obtrusive character.

In 1866, McCoy, in an essay on the Recent Zoology and Palaeontology of Victoria, mentions a plant from the Bacchus Marsh Sandstones, "of the size, shape, and reticulated venation of the *Glossopteris Browniana*, but without the midrib," and

incidentally remarks that he had proposed the name *Gangamopteris*, and that *G. angustifolia* occurred in the New South Wales coal plant-beds with *Glossopteris browniana*.

A little more than ten years later we gain important information concerning these plants, for in 1875 McCoy published figures and descriptions of three distinct species in his Prodrômus of the Palaeontology of Victoria. *G. angustifolia* is characterised by its great length and narrowness, being as much as a foot long, though usually less than one inch wide.

G. obliqua is a very wide, unequal sided, oblique form of variable size; while *G. spatulata* is a symmetrical broad-bladed knife-like form of a few inches in length.

Though these three forms were distinguished from one another and given different specific names, McCoy was fully alive to the possibility of all three belonging to the same plant, and he expresses himself very clearly on this point.¹

On the evidence of these Gangamopterids, as interpreted by McCoy, a Mesozoic age was assigned to these beds.

Then in 1892 there was a fresh burst of enthusiasm, in view of the added interest in the discovery of numerous glaciated pebbles in the associated conglomerates, and the Annual Report for the Department of Mines of Victoria included a brief record of the occurrence of other plants, such as *Schizoneura* and *Zengophyllites*. This addition is, I think, sufficiently interesting to quote McCoy's remarks in full:—"Among the more interesting results of my investigations during the year (1891) is the recognition for the first time of, probably, Lower Triassic Rocks of the Bunter Sandstein age, in the geological series of Victoria. For this determination I have had only a few fragmentary examples filled with comminuted plant remains from a newly-discovered bed just under the famous Gangamopteris sandstone of Bacchus Marsh. These few specimens, containing small fragments of plants from below the building sandstones of Bacchus Marsh, are of the highest interest, as the only fossil remains found in any connection with the Gangamopteris sandstones. One of the plant fragments seems clearly to indicate a *Schizoneura*, and if this identification be borne out by additional specimens, which should be procured, the indication

¹ Prod. Pal. Vic., Dec. ii., p. 12.

will be the addition to the geological map of Victoria of the Lower Trias formation, or Bunter Sandstein, or Grés Biggarré, leaving my old impression that the Gangamopteris beds were Upper Trias or Keuper, as corroborated by the first relative evidence. The other fragments seem referable to the *Zeugophyllites*, and would indicate in my opinion a slightly newer date."

The next item worthy of notice is in 1894, when McCoy adds *Ptilophyllum officeri* in the Proceedings of the Royal Society of Victoria, in a very brief note as an appendage to a paper by Messrs. Officer and Balfour entitled, "Further Note on the Glacial Deposits of Bacchus Marsh." The meagreness of this description, its out-of-the-way inclusion in another paper, and the absence of any illustration, will all tend to increase the difficulty of recognition of this species, even if we accept the generic location as correct.

Four years later, 1898, we have a specially interesting record in the Proceedings of the Royal Society of Victoria, by the same author, firstly, in the addition of a new species, *Taeniopteris sweeti*, and secondly that it was the closing episode to a great career. Early in the year following the publication of this paper Sir Frederick McCoy died, and no greater testimony to his wonderful vitality and interest in his work up to the last moment could be given than by noting his attitude in this, his last paper. He regarded this occurrence of *Taeniopteris* as a further confirmation of his belief in the Mesozoic age of the rocks.

Although we may not accept all his opinions, still we must recognise our indebtedness to him for the information we have on this highly interesting flora.

The strange way in which credit may be very easily perverted by the fallacy of reference is well illustrated in connection with a remark of Mr. E. A. Newell Arber¹, in his work on the *Glossopteris* Flora, published in 1905. He says: "The first mention of the latter (*Gangamopteris*) genus was apparently that by Selwyn in 1866, who identified it from the Bacchus Marsh Beds." Yet McCoy mentions it at the same

¹ B. M. Cat., *Glossopteris* Flora, 1905, p. lvi.

date, and the recognition of his genus dates from 1861, even on Mr. Arber's own showing on p. 102.

The next point that calls for comment on Mr. Arber's work is that in his historical sketch¹ he accepts *G. angustifolia*, McCoy, as a good species, but relegates both *G. spatulata* and *G. obliqua* to the synonymy of *G. cyclopteroides*, Feistmantel, a well known Indian species.

Later,² when dealing with the flora, he remarks, "I regard McCoy's *G. obliqua*, and possibly also *G. spatulata*, as identical with the Indian fronds included here under this species. If this be the case, one of his specific names should, strictly speaking, have priority over Feistmantel's *G. cyclopteroides*, but the latter term has become so widely known that I have hesitated to make any change."

It is therefore obvious that there is no legitimate reason why McCoy's specific name should not be recognised according to the ordinary rules of priority. McCoy's two species may refer to the same plant, but in the absence of any direct evidence of that fact, it is most convenient to retain both names, and *G. obliqua*, McCoy, should replace *G. cyclopteroides*, Feistmantel. In the event of *G. spatulata* and *G. obliqua* being satisfactorily proved to be the same thing, even then *G. spatulata*, McCoy, is the name that should be upheld as against Feistmantel's species.

A further remark of Mr. Arber's on the Victorian Flora³ requires some modification—"In 1878 and 1890, Feistmantel described the above species without any further additions to the flora except *Phyllothea australis*, Brong., from Cape Paterson, Victoria." This evidently implies that the Cape Paterson beds belong to the same general horizon as the Bacchus Marsh beds, and that they represent the Glossopteris Flora Period. Feistmantel apparently obtained this record from a Victorian Progress Report, and no question has been raised as to the validity of the identification in the first place; but locally the Cape Paterson beds are regarded as an essential part of the Jurassic Coal Measures, and their flora as a whole is distinctly younger than the Glossopteris Flora.

1 Id.

2 Id., p. 106.

3 Id., p. lvi.

I have now a very important addition to make to the Bacchus Marsh Sandstone Flora in the genus *Calamites*, and this record is a strikingly strong confirmation of the correctness of placing these beds on the Permo-Carboniferous horizon, and of referring its fossil plant remains to the Glossopteris Flora. During November last I had a party of students at Bacchus Marsh for field geological work, and during our investigations in the lower Gangamopteris quarry overlooking the Korkuperrimal Valley, one of my assistants, Mr. Stanley Mitchell, drew my attention to a plant impression on a large block of stone, and on this being opened out, several points of interest presented themselves. The most likely portions for study were carefully wrapped up and considered later. I then found that some portions had been left behind, which might possibly throw further light on the specimen as a whole. Accordingly, accompanied by Mr. V. R. McNab, I paid another visit to the locality, and we were fortunate enough to secure the missing parts, and to open up several other similar impressions.

CALAMITES MACNABI, sp. nov.

In this preliminary note I desire to name as above, certain stem impressions, and stem impressions with lateral branches, the latter being charged with narrow linear leaf impressions.

The first specimen is on a slab about 18 inches broad by 8 inches high, and shows a broad flattened stem impression of 6 inches width, showing two nodal regions and a portion of a third, and these regions are placed approximately 3 inches apart. From the two well-defined nodal regions, two side branches are given off, each about one inch wide. Adjoining these branches are the leaf impressions, apparently carried on a thin, sheath-like envelope. There are about 3 or 4 leaf impressions in the inch width, but instead of showing a regular annular arrangement they appear to be in oblique series. On these branches the leaf impressions are about three-quarters of an inch in length, and about one-sixteenth to one-twentieth of an inch broad at the base, with a strong medial ridge.

Another specimen showing a narrower stem, about $2\frac{1}{2}$ inches at the nodal region, shows a much greater distance between

the nodes, than already indicated for the larger example, in that a stem length of 8 inches only shows one nodal region.

From the same slab as the last, another leaf bearing stem of about 14 inches in length was procured. This specimen, when fully opened up, will, I think, show leaf impressions of upwards of 2 inches in length, and some additional characters may perhaps be made out.

On comparing these specimens with others, one would naturally look first to New South Wales, and in Feistmantel's fine work on the Coal and Plant-bearing Beds of Palaeozoic and Mesozoic Age of Eastern Australia and Tasmania, the record of a *Calamites* may be noted from Smith's Creek, near Stroud. This specimen is named straight out as *C. radiatus*, Brong., a well-known European species, but considering the amount of material and its evident state of preservation, there may be some room for doubt as to the correctness of this identification. Our Bacchus March specimens appear to agree fairly closely with the specimens from New South Wales, as figured by Feistmantel, Plate III., Figs. 1-3, and I should not be surprised if they ultimately proved to be the same, but for the present at any rate, I think it preferable to refer to the Bacchus Marsh specimens under a distinctive name.